Epidural anesthesia

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Epidural anesthesia

- A reversible loss of sensation and motor function similar to spinal anesthesia (lesser degree of motor block).
- Larger doses of local anesthetic are required to produce anesthesia when compared to a spinal anesthesia.
- Doses must be monitored to avoid toxicity.

Spinal vs. Epidural.
How do we decide?

- Need for reinjection due to the length of procedure?
- Need for intraoperative top-up of anesthesia level?
- Need of post-operative analgesia?

Epidural catheter

- **To extend the DURATION and the LEVEL of anesthesia beyond the original dose by intra-operative administration of additional local anesthetic.**
- **May be left in place and be used for post-operative analgesia.**

Indications for epidural

Surgical anesthesia

- Cesarean section
- Gynecological procedures (uterus, salpinx)
- Hernia repairs
- Genitourinary procedures
- Lower extremity orthopedic procedures
- +/- perineum (higher failure rate)

Analgesia

- **Acute pain**
  - Post-operative
  - Flail chest
  - LABOR!!!
- **Chronic pain**

Epidural anesthesia

ADVANTAGES

- Easy to perform (more skills required than spinal)
- Reliable form of anesthesia, good operating conditions
- Advantages of epidural catheter
- Avoiding risk of PDPH (but attention to accidental dural puncture)
- Preservation of gastrointestinal function
- Patent airway
- Fewer pulmonary complications than Gen Anest
- Decreased incidence of deep vein thrombosis and pulmonary emboli formation compared to Gen Anest
- Slower onset of sympathetic blockade than spinal

DISADVANTAGES

- Risk of block failure (higher than a spinal)
- Onset is slower than spinal anesthesia.
- Higher risk of hematoma, infections etc. than spinal
- Continuous epidural catheters should not be used on the ward if the patient's vital signs are NOT closely monitored.

Epidural contraindications

ABSOLUTE

- Patient refusal
- Infection at the site of injection
- Coagulopathy
- Severe hypovolemia
- Increased Intracranial pressure
- Severe Aortic Stenosis
- Severe Mitral Stenosis
- Ischemic Hypertrophic Sub-aortic Stenosis

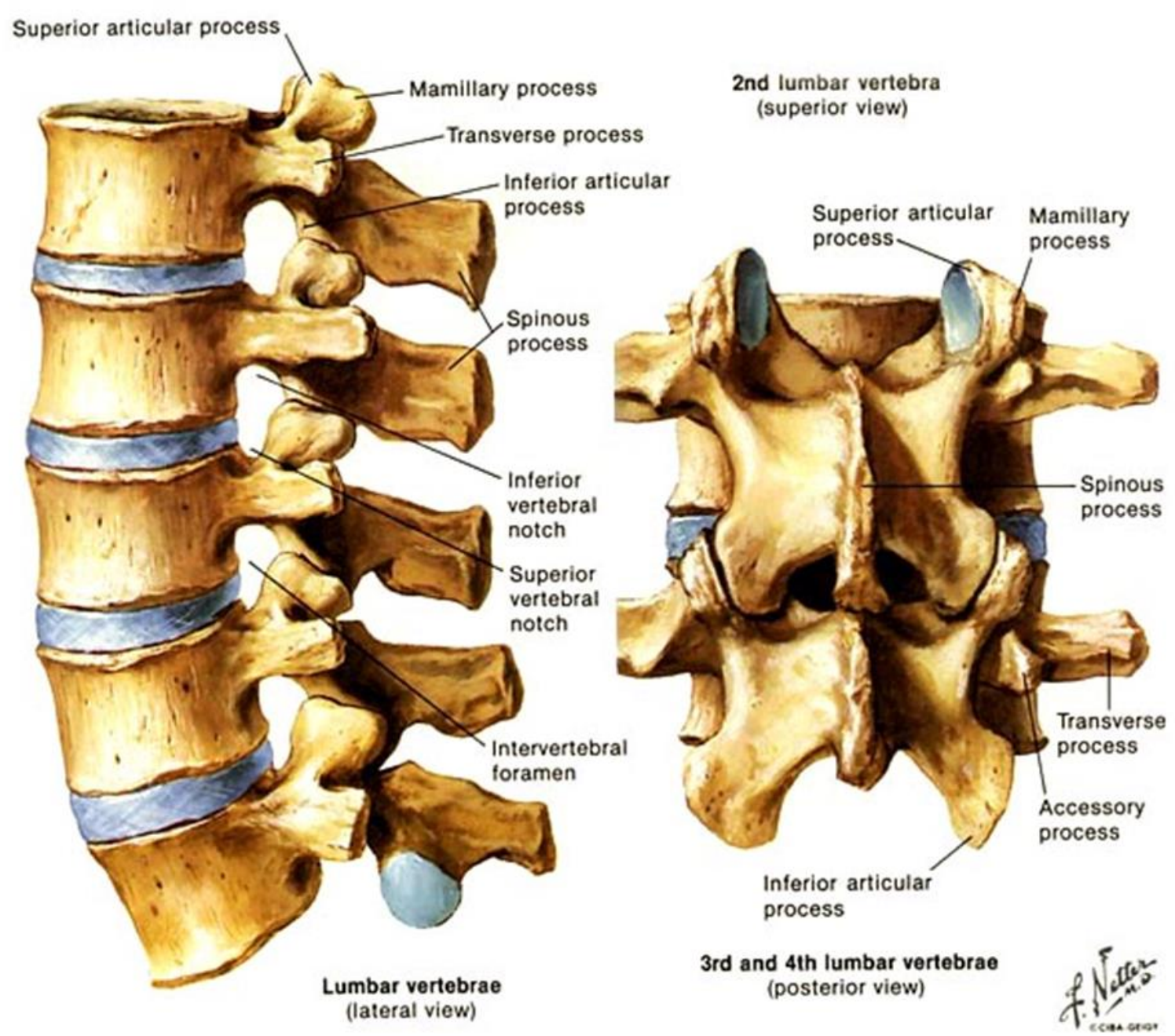
RELATIVE

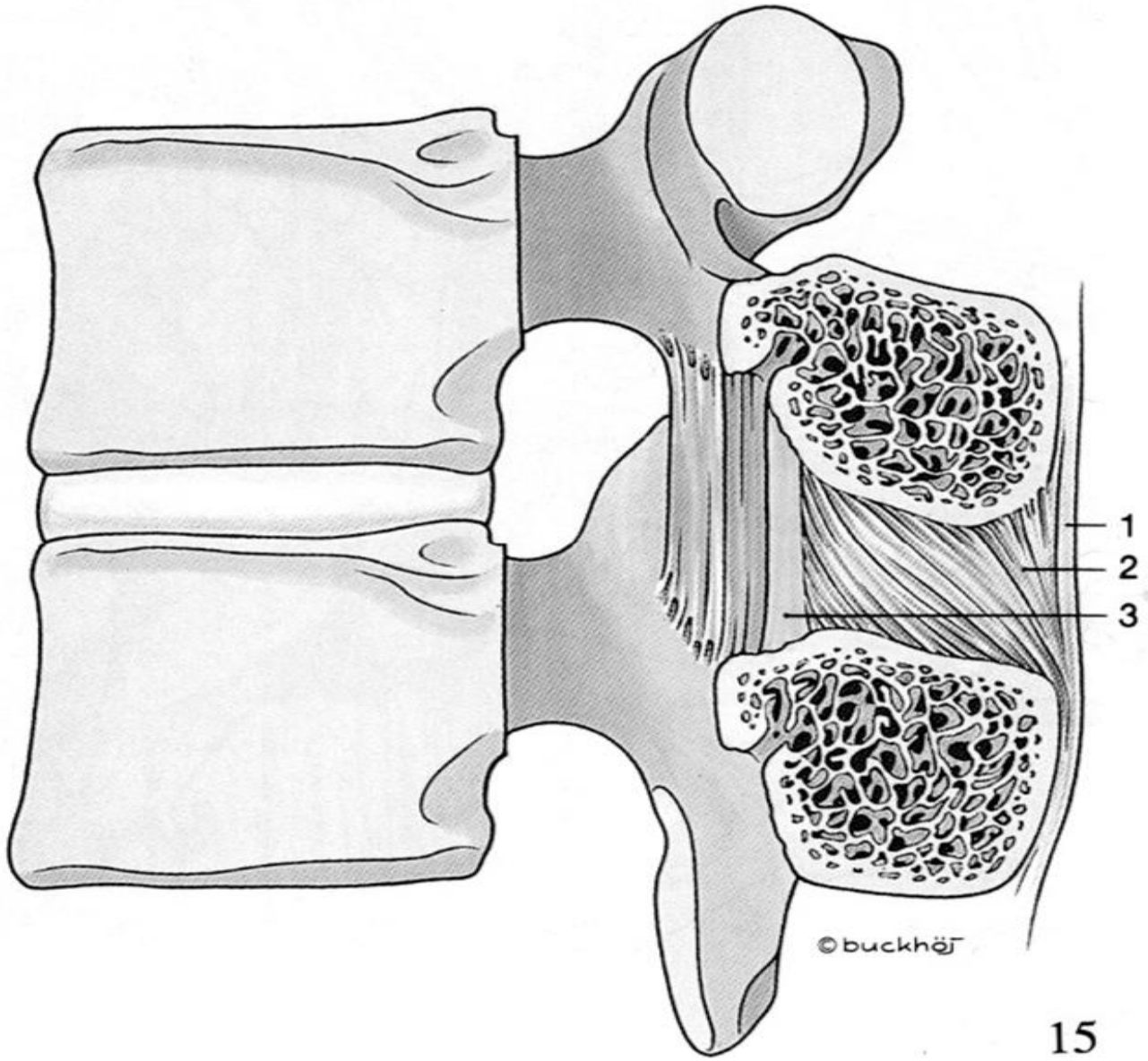
- Sepsis
- Uncooperative patients
- Pre-existing neuro deficits/neurological deficits
- Demylenating lesions
- Stenotic valuvular heart lesions (mild to moderate Aortic Stenosis/Ischemic Hypertrophic Sub-aortic Stenosis)
- Severe spinal deformities
- Prior back surgery
- Complicated surgery (prolonged time, major blood loss, maneuvers that may complicate respiration)

Prior consent for the risks of epidural anesthesia

- **Failure**
- **Paresthesias**
- **Backpain**
- **PDPH**
- **Bleeding**
- **Infection**
- **Local anesthetic toxicity**

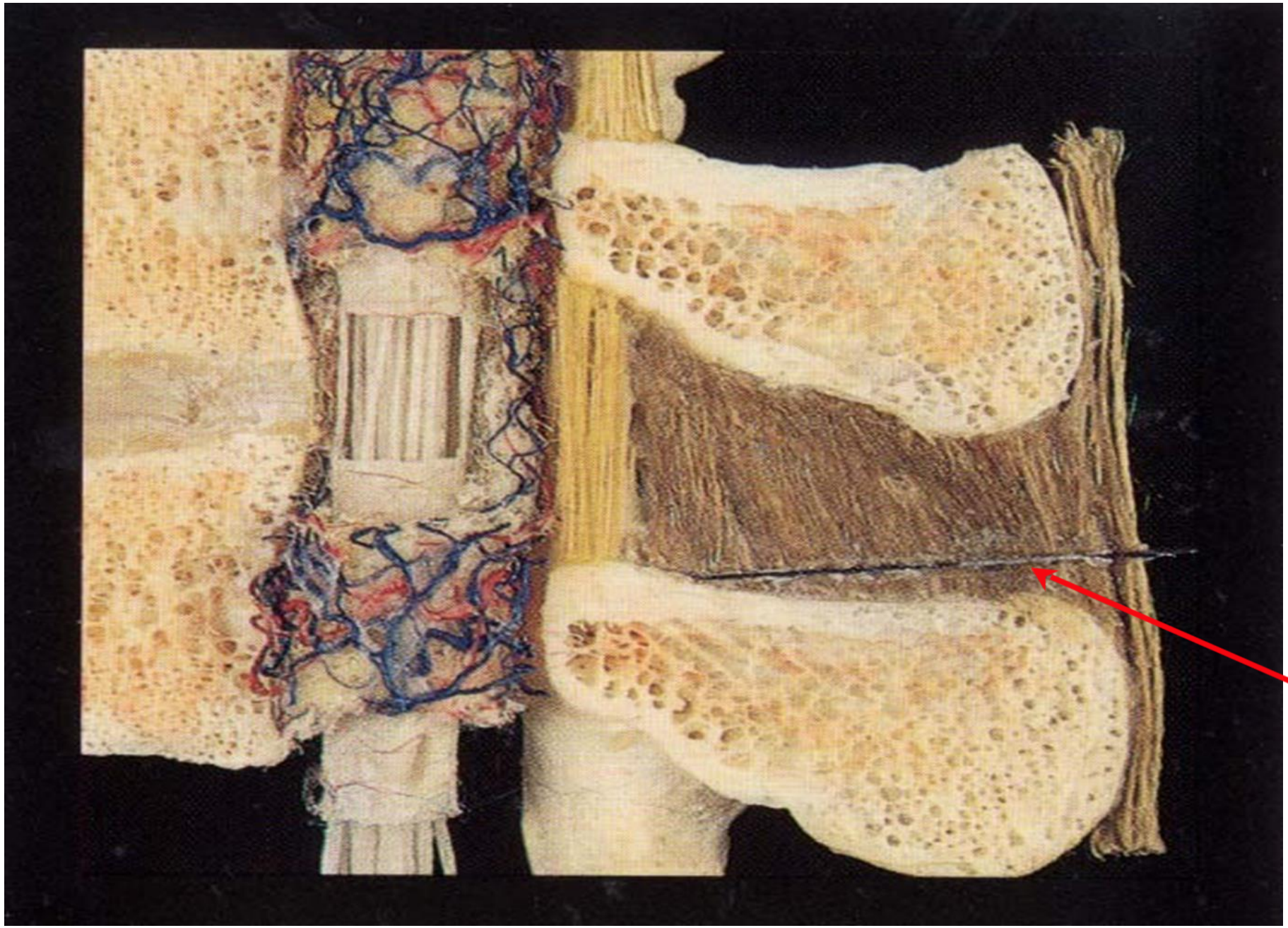
Lumbar spine anatomy

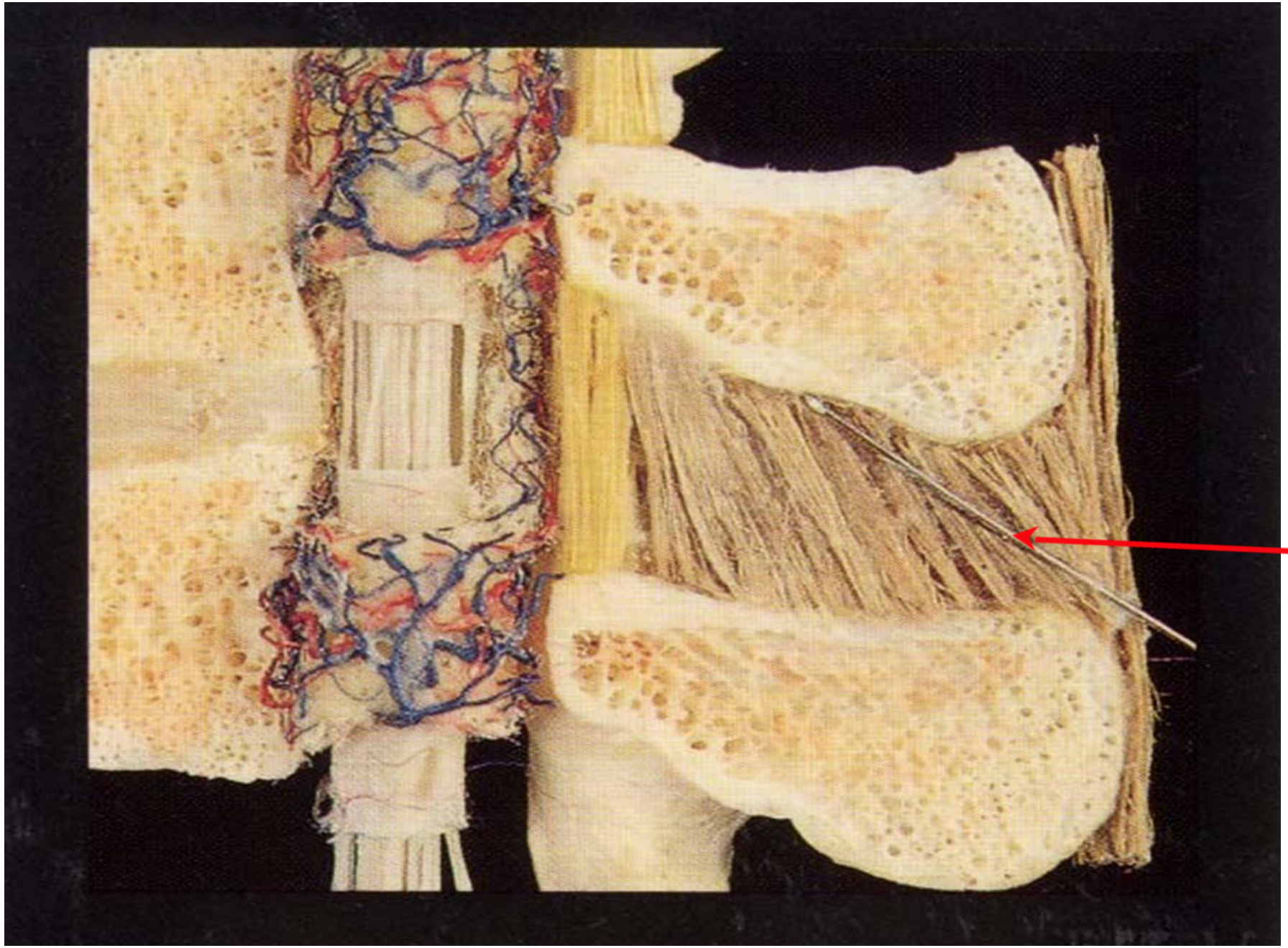

Superior articular process
Mamillary process
Transverse process
Inferior articular process
Spinous process
Inferior vertebral notch
Superior vertebral notch
Intervertebral foramen
Lumbar vertebrae
(lateral view)
2nd lumbar vertebra
(superior view)
Superior articular process
Mamillary process
Spinous process
Transverse process
Accessory process
Inferior articular process
3rd and 4th lumbar vertebrae
(posterior view)

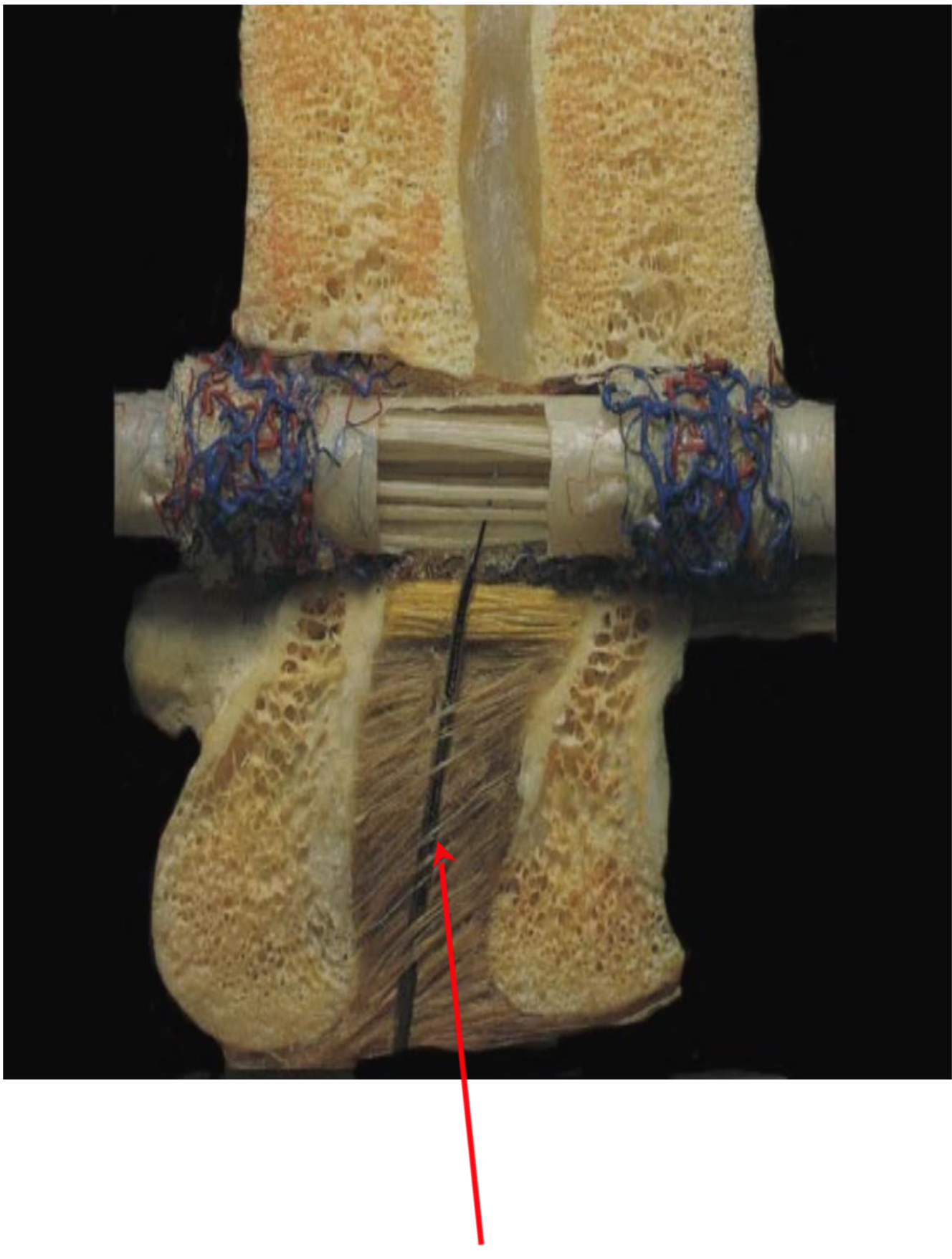


Spinal ligaments

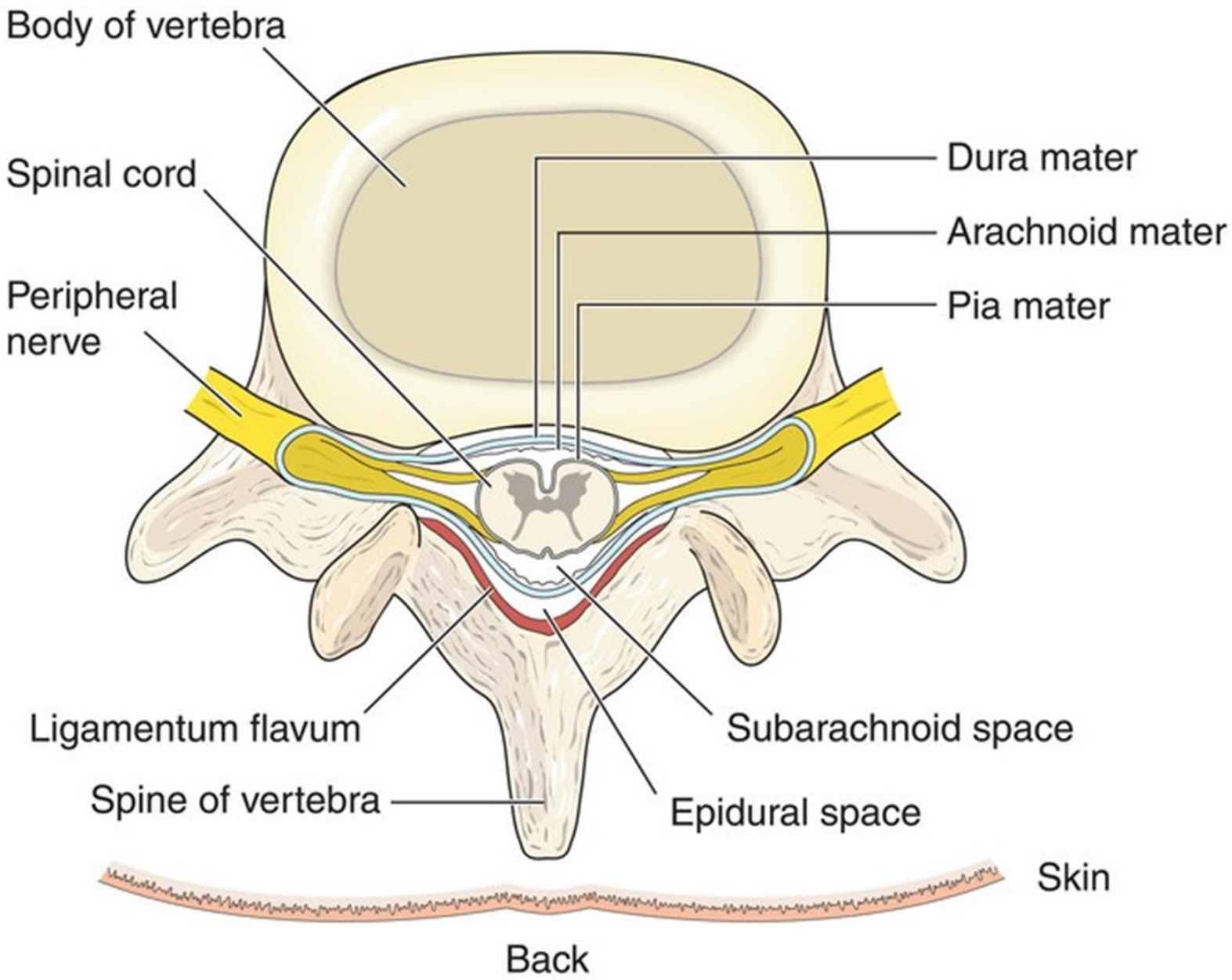
1. lig. supraspinous
2. lig. interspinous
3. ligamentum flavum

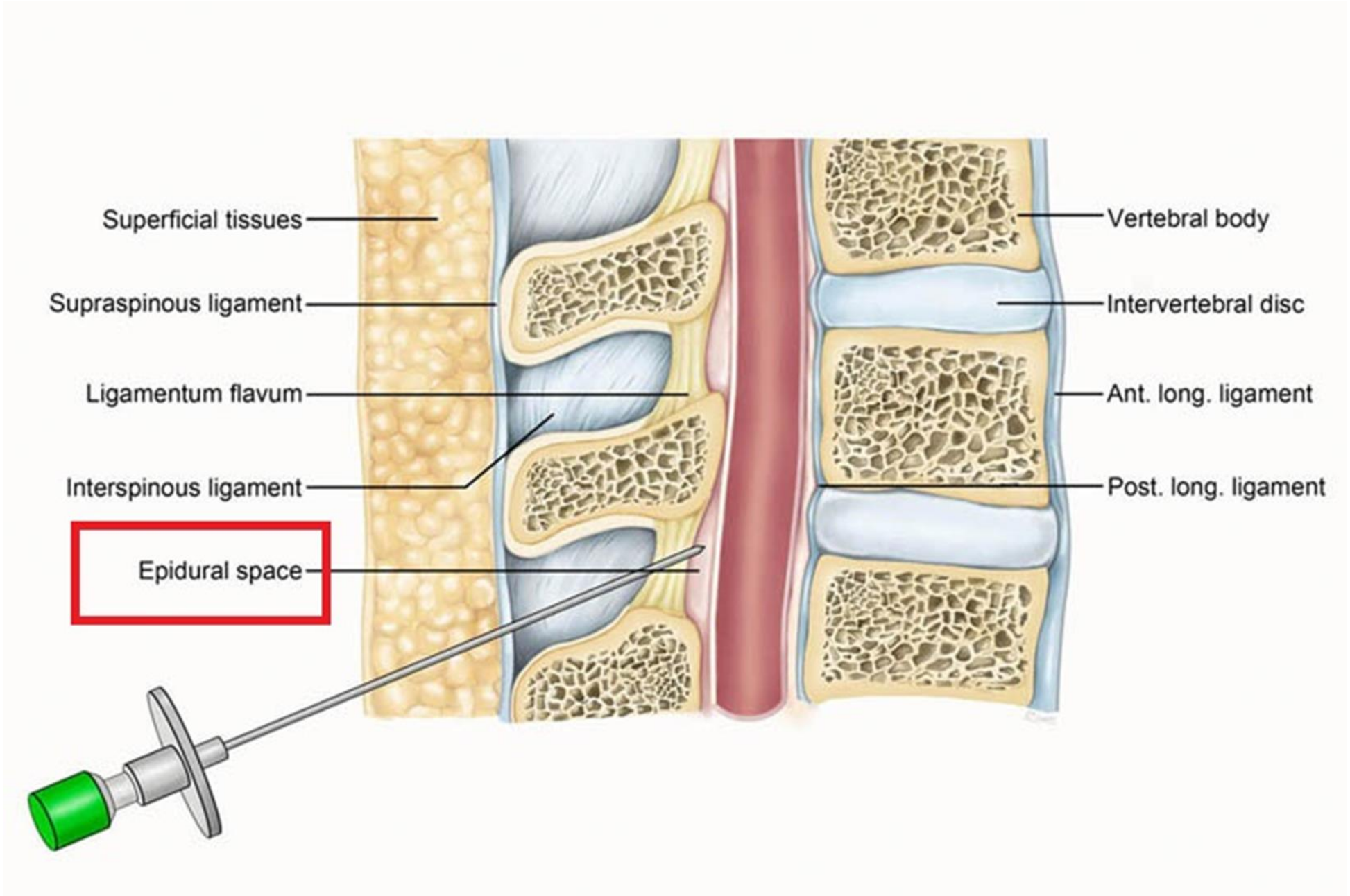


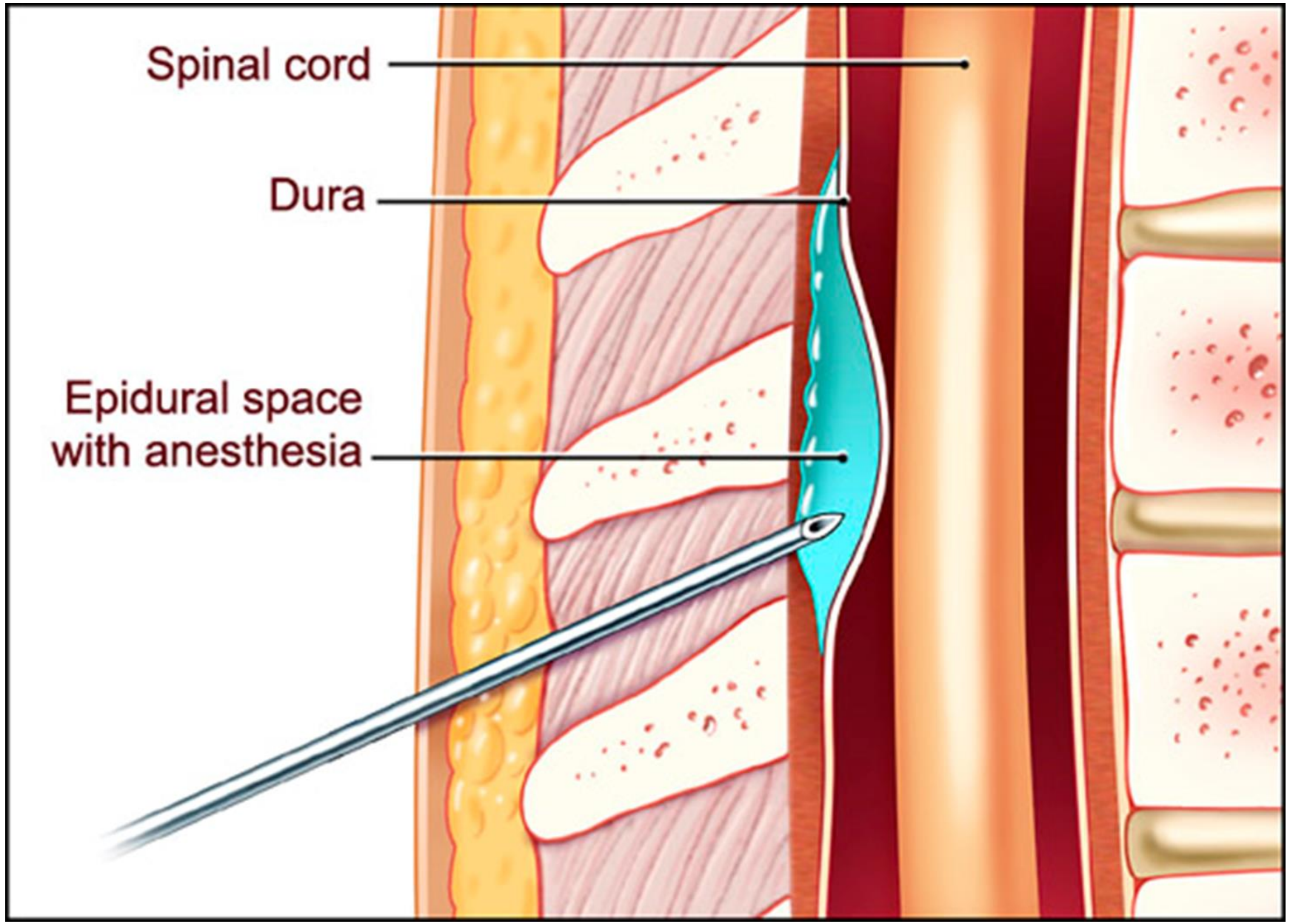




Epidural space anatomy


Body of vertebra
Spinal cord
Peripheral nerve
Dura mater
Arachnoid mater
Pia mater
Ligamentum flavum
Subarachnoid space
Spine of vertebra
Epidural space
Skin
Back


Superficial tissues
Supraspinous ligament
Ligamentum flavum
Interspinous ligament
Epidural space
Vertebral body
Intervertebral disc
Ant. long. ligament
Post. long. ligament


Spinal cord
Dura
Epidural space
with anesthesia

Epidural space identification

”Loss of resistance” technique

“Hanging drop” technique

Loss of resistance technique with AIR or LIQUID?

Loss of resistance technique

against AIR

- Incomplete analgesia
- More difficult catheter placement
- Increased paresthesias
- Increased PDPH
- Risk of intratechal air
- Risk of infection
- Venous air embolism
- Nerve root compression

against LIQUID

- Can not differentiate a dural tap
- saline vs. CSF ?
  - temperature?
  - pH
  - proteins
  - glucose

Loss of resistance technique with AIR or LIQUID?

3 meta-analyses

Schier R. *Epidural space identification: a meta-analysis of complications after air versus liquid as the medium for loss of resistance.* Anesth Analg. 2009 Dec;109(6):2012-21.

LS Grondin et al. *Success of Spinal and Epidural Labor Analgesia: Comparison of Loss of Resistance Technique Using Air Versus Saline in Combined Spinal-Epidural Labor Analgesia Technique.* Anesthesiology 111 (1), 165-172. 7 2009.

CL Sanford et al. *Evidence for Using Air or Fluid When Identifying the Epidural Space*. AANA J 81 (1), 23-28. 2 2013.

NO DIFFERENCES

BUT USE YOUR PREFERRED TECHNIQUE!

Segal S, Arendt KW. *A retrospective effectiveness study of loss of resistance to air or saline for identification of the epidural space.* Anesth Analg. 2010 Feb 1;110(2):558-63.

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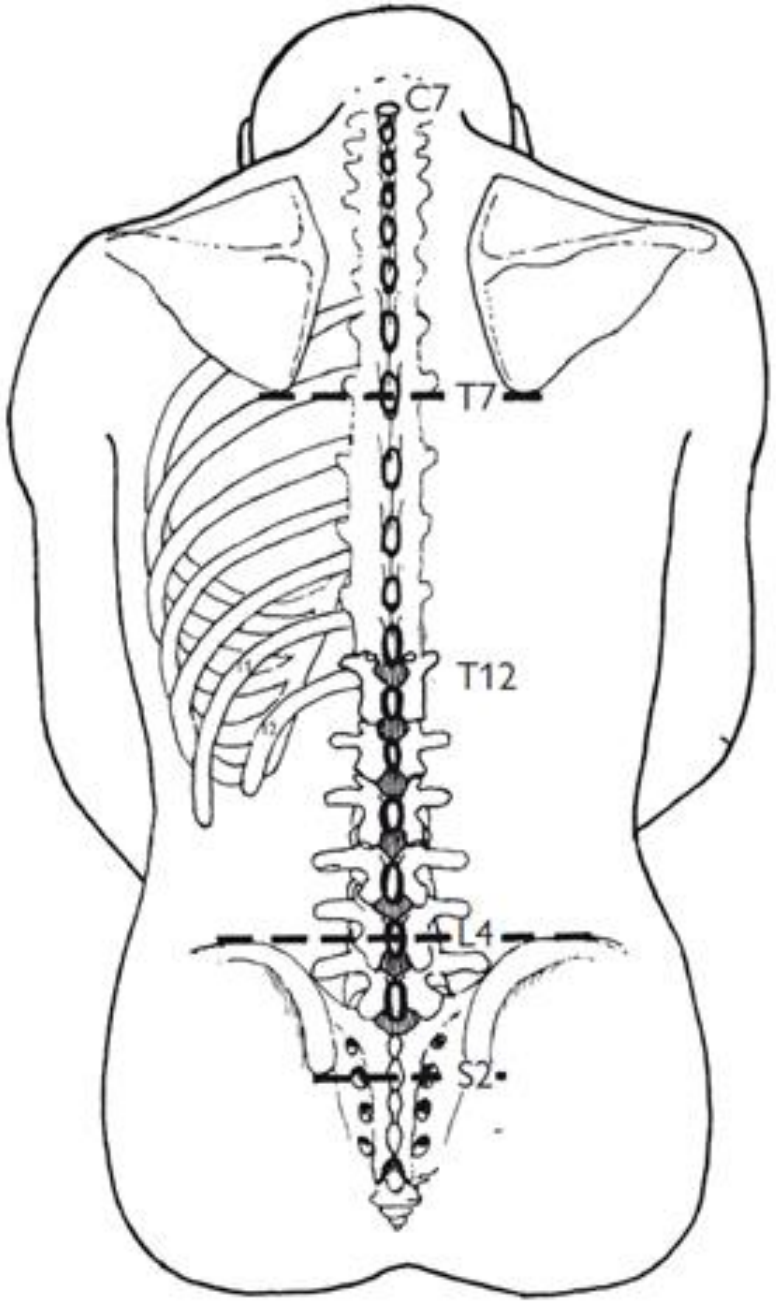
Patient postioning

Sitting or Lateral decubitus?

…Only 10% of worldwide anesthesiologists are using lateral position…


C7
T7
T12
L4
S2

Poor anatomical landmarks identification by experienced anesthetists

Broadbent CR. Ability of anaesthetists to identify a marked lumbar interspace. Anaesthesia 2000;55:1122–6

Only 29% correct identifications of lumbar interspace

In 51% of cases the level was higher than predicted (1-4 interspaces)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L4
L5
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Lateral vs. Sitting position

Lateral	Sitting
- less movement (bed friction)	
- less venous puncture	- better anatomical landmarks
- better confort (not in obese patients)	- better patient confort in obese patients (BMI > 30)
- due to patient condition – impossibility to seat	

Vincent RD, Chestnut DH. *Which position is more comfortable for the parturient…?* Int J Obst Anaesth 1991; 1 (1): 9-11.
Bahar M. *Lateral recumbent head-down posture for epidural catheter insertion reduces...* Can J Anaesth 2001;48(1):48-53.
Harney D. *Influence of posture on the incidence of vein cannulation…*EJA 2005; 22 (2): 103-106.

Test Dose?

Solution injection before catheter placement?

Gadalla F. *Injecting saline through the epidural needle decreases the IV epidural catheter placement ….* Can J Anaesth 2003; 50: 382–5.

- 100 parturients
- sitting position
- L2-L3, L3-L4
- multiport catheter, flexible
- 3-5 cm cephalad (4,5 cm)

- 0 ml vs. 10 ml saline through epidural needle prior to catheter insertion (50 / 50 patients)

RESULTS

IV placement (blood in catheter)

1/50 (2%) in saline group

10/50 (20%) in ”dry” group

Conclusion:

Epidural bolus before catheter placement!

- **Saline**
- **Lidocaine**
- **Local anesthetic**

Epidural Fentanyl ?

Epidural Fentanyl ?

- **Bolus :** Segmental (Spinal)
- **Continuous infusion :** nonsegmental, supraspinal (similar with IV) analgesia
- **100 micrograms is a dose threshold for effect**
- **Pottency 3/1 Epidural vs. IV**

Ginosar et al. Anesth Analg 2003; 97:1428-38.

Eichenberger et al. BRJA 2003; 90: 467-73.

Factors affecting anesthetic level?

Factors affecting anesthetic level?

SPINAL

- **Baricity**
- **Dose**
- **Patient position**

EPIDURAL

- **Volume of local anesthetic**
- **Age**
- **Height of the patient**
- **Gravity**

Volume of local anesthetic

- Can be variable
- General rule: 1-2 ml of local anesthetic per dermatome

e.g. epidural placed at L4-L5; you want a T4 block for a C-sec. You have 4 lumbar dermatomes and 8 thoracic dermatomes. 12 dermatomes X 1-2 ml = 12-24 ml

- Big range! Stresses importance of incremental dosing!
- The majority of the solutions is absorbed systemically through the venous plexus (peak blood concentrations in 10-30 min after a bolus)
- Epidural fatty tissue acts as a reservoir.
- The rest of LA reaches the spinal nerve and nerve roots.

Add dural puncture?

Add dural puncture?

COMBINED SPINAL EPIDURAL

Complications

Hypotension

Bradycardia

Nausea/Vomiting

Vagal syncope

Paresthesias

Backpain

Bleeding (spinal/epidural hematoma)

Infection

PDPH

High / total spinal

Local Anesthetic toxicity

Local Anesthetics used for Epidural Anesthesia

Long Acting Bupivacaine

- Long acting amide local anesthetic
- 0.5% used for surgical anesthesia
- 0.1-0.125-0.25% used for epidural analgesia
- Bupivacaine has a high degree of protein binding and lipid solubility which accumulate in the cardiac conduction system and can results in the advent of refractory reentrant arrhythmias

Long Acting Levobupivacaine

- S isomer of bupivacaine
- Used in the same concentrations
- Clinically acts just like bupivacaine with the exception that it is less cardiac toxic

Long Acting Levobupivacaine

Agent	Concentration	Onset	Sensory Block	Motor Block	Plain Solution	1:200,000 Epinephrine
Levobupivacaine	<0.25%	Slow	Dense	Minimal to moderate		
Levobupivacaine	0.5-.75%	Same	Dense	Mild to dense	150-225 minutes	150-240 minutes

Long Acting Ropivacaine

- Long acting amide local anesthetic
- Mepivacaine analogue
- Used in concentrations of 0.5-1% for surgical anesthetic
- Used in concentrations of 0.1-0.3% for analgesia
- Ropivacaine is unique among local anesthetics since it exhibits a vasoconstrictive effect at clinically relevant doses

Long Acting Ropivacaine

- Similar to bupivacaine in onset, duration, and quality of anesthesia
- Key differences include: in doses for analgesia there is excellent sensory blockade with low motor blockade and it is less cardiotoxic than bupivacaine

Long Acting Ropivacaine

Agent	Concentration	Onset	Sensory Block	Motor Block	Plain Solution	1:200,000 Epinephrine
Ropivacaine	0.1-0.2%	Slow	Analgesic	Minimal		
Ropivacaine	0.5%	Same	Dense	Mild to moderate		
Ropivacaine	0.75-1%	Same	Dense	Dense	140-180 minutes	150-200 minutes